REMARKS

Claims 1-19 are pending in the present application. Claims 1-8 are withdrawn.

Claim Rejections

Claims 9 and 12 recite a manufacturing method of a semiconductor device. The manufacturing method includes steps for forming a gate insulation film. The steps include forming a silicon oxide film over the silicon substrate. In claim 9, nitrogen is introduced into the silicon oxide film for displacing silicon atoms on a surface of the silicon substrate towards the gate insulation film side. In claim 12, nitrogen is introduced into the silicon oxide film for displacing silicon atoms on the surface of the silicon substrate in a region where a conductive type of the surface is P-type below the gate insulation film toward the gate insulation film side; and displacing silicon atoms on the surface in a region where the conductive type of the surface is N-type below the gate insulation film toward an inner side of the silicon substrate.

A. Rejection based on Rodder

Claims 9, 12, and 15-19 were rejected under 35 U.S.C. § 102(b) as being anticipated by ***Rodder*** (U.S. Patent No. 6,251,761). Favorable reconsideration is requested.

Rodder discloses a process for polycrystalline silicon gates and high-K dielectric compatibility. The process includes forming a silicon dioxide layer 118 over a semiconductor 102. The silicon dioxide layer 118 is subjected to remote plasma nitridation converting the silicon dioxide layer 118 to a silicon-oxynitride layer 106. (Col. 3, lines 25-28.)

Applicants respectfully submit that Rodder does not disclose "displacing silicon atoms on a surface of said silicon substrate toward said gate insulation film" as recited in claim 9 and "displacing silicon atoms on a surface of said silicon substrate in a region where a conductive type of said surface is P-type below said gate insulation film toward said gate insulation film side" as recited in claim 12.

Rodder discloses using plasma nitridation to convert the silicon dioxide layer to a silicon-oxynitride layer. (Col. 3, lines 25-28.) Because plasma nitridation is used, the interatomic distance is reduced since a compressive stress is produced. (Specification, page 9; page 13; Fig. 4.) Thus, in contrast to claims 9 and 12, silicon atoms on a surface of the silicon substrate are displaced away from the gate insulation film.

The Examiner takes the position that Rodder discloses products produced by an identical or substantially identical process to the claimed process, and therefore, a *prima facie* case of anticipation has been established. (Office Action, page 3.) However, the process in Rodder is not identical or even substantially identical to the process claimed in claims 9 and 12. As stated above, silicon atoms on a surface of the silicon substrate are displaced away from the gate insulation film since Rodder discloses using a plasma nitridation process.

Rodder discloses a different process from that recited in claims 9 and 12. Specifically, Rodder discloses that silicon atoms on a surface of the silicon substrate are displaced away from the gate insulation film. Therefore, Rodder does not disclose the elements as recited in claims 9 and 12.

Furthermore, regarding claim 12, Rodder is silent about forming an n-channel MOS transistor and a p-channel MOS transistor in parallel with each other so that a semiconductor device is manufactured having the n-channel MOS transistor and the p-channel MOS transistor. Therefore, for this additional reason, Rodder does not disclose the elements as recited in claim 12.

B. Rejection based on Niimi

Claims 9-14 were rejected under 35 U.S.C. § 102(e) as being anticipated by ***Niimi*** (U.S. Patent No. 6,548,366). Favorable reconsideration is requested.

Niimi discloses a method of two-step annealing of ultra-thin silicon dioxide layers for a uniform nitrogen profile. The process includes forming a silicon dioxide layer 103 on a silicon substrate 101. The silicon dioxide layer is subjected to a plasma nitridation process by exposing the silicon dioxide layer 103 to plasma 201, containing nitrogen. (Col. 4, lines 31-33.)

Applicants respectfully submit that Niimi does not disclose "displacing silicon atoms on a surface of said silicon substrate toward said gate insulation film" as recited in claim 9 and "displacing silicon atoms on a surface of said silicon substrate in a region where a conductive type of said surface is P-type below said gate insulation film toward said gate insulation film side" as recited in claim 12.

Niimi discloses exposing the silicon dioxide layer to plasma nitridation. (Col. 4, lines 31-33.) Because plasma nitridation is used, the interatomic distance is reduced since a compressive stress is produced. (Specification, page 9; page 13; Fig. 4.) Thus, in contrast to claims 9 and 12,

silicon atoms on a surface of the silicon substrate are displaced away from the gate insulation film.

The Examiner takes the position that Niimi discloses products produced by an identical or substantially identical process to the claimed process, and therefore, a *prima facie* case of anticipation has been established. (Office Action, page 3.) However, the process in Niimi is not identical or even substantially identical to the process claimed in claims 9 and 12. As stated above, silicon atoms on a surface of the silicon substrate are displaced away from the gate insulation film since Niimi discloses using a plasma nitridation process.

Regarding claim 13, applicants respectfully submit that Niimi does not disclose:

> conducting a first heat treatment to said silicon dioxide film in a ammonia atmosphere or nitrogen monoxide atmosphere in said region where the conductive type of said surface is P-type, and conducting a plasma nitridation treatment to said silicon dioxide film in an ammonia atmosphere or nitrogen monoxide atmosphere in said region where the conductive type of said surface is N-type

as recited in claim 13. Niimi discloses exposing the silicon oxide film to plasma nitridation and an additional step of annealing and re-oxidation. However, Niimi does not disclose conducting a first heat treatment to the silicon oxide film in an ammonia atmosphere or nitrogen monoxide atmosphere in the region where the conductive type of the surface is P-type and plasma nitridation in the region where the conductive type of the surface is N-type. Thus Niimi does not disclose the elements as recited in claim 13.

C. Rejection based on Niimi in view of Chau

Claims 15-18 were rejected under 35 U.S.C. § 103(a) as being unpatentable over ***Niimi***

(U.S. Patent No. 6,548,366) in view of ***Chau*** (U.S. Patent No. 6,713,358). Favorable reconsideration is requested.

The Examiner acknowledges that Niimi does not disclose forming a silicon nitride film or high dielectric constant film over said silicon oxide film and conducting a second heat treatment to said silicon oxide film, after said step of introducing nitrogen and displacing silicon atoms. However, the Examiner cites Chau for disclosing such features.

Regarding claims 16-18, Applicants respectfully submit that Chau does not disclose that after the step of forming a silicon nitride film or high dielectric constant film, "conducting a second heat treatment to said silicon oxide film, to which nitrogen has been introduced."

Chau discloses forming a high dielectric constant film over a substrate and a silicon nitride layer over the high dielectric constant film using a PECVD process. (Col. 2, lines 41-45.) However, Chau does not disclose a second heat treatment after either forming the high dielectric constant film or forming the silicon nitride film. In other words, although the silicon nitride film is formed by the PECVD method, there is no second heat treatment. Since there is no second heat treatment, the effect of the present invention is not obtained in Chau. Specifically, the silicon atoms are not further displaced toward the gate insulation film side. On the other hand, in Chau, the silicon atoms may be displaced toward the opposite side when the silicon nitride film is formed by the PECVD method, as shown in Fig. 16 in the present application. Therefore, Niimi in view of Chau does not teach or suggest the elements as recited in claims 16-18.

For at least the foregoing reasons, claims 9-19 are patentable over Rodder, Niimi, and Niimi in view of Chau.

Accordingly, withdrawal of the rejection of claims 9, 12 and 15-19 based on Rodder, claims 9-14 based on Niimi, and claims 15-18 based on Niimi in view of Chau is hereby solicited.

In view of the remarks above, Applicants submit that that the claims are in condition for allowance. Applicants request such action at an early date.

If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicants' undersigned attorney to arrange for an interview to expedite the disposition of this case.

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

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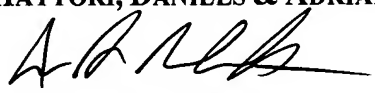

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